BAMBOO AS FIBER REINFORCEMENT IN CONCRETE IN CONCRETE MIX

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ABSTRACT

Today they are many incorporated concrete with addition materials to improve the quality of the concrete. This study is focus on usage of the natural admixtures to be incorporated in the concrete mixtures specifically bamboo fiber. Bamboo has naturally characteristic which can grow fast, making it an easily replenish able resource. Bamboo is natural vegetation and normally grown in tropical countries. This fiber is made of cellulose and is being produced by processing methods such as steaming and boiling, and many more. By mixing a concrete using this material, it will give some advantages where more economical and reliable in term of quality and also supporting the load. This study was conducted to determine whether or not the bamboo fiber can be used as one of many materials to increase concrete durability (compression strength) quality and the flexural strength of the specimens and deflection of concrete mix with bamboo fiber. Concrete grade of 20 will be used during the preparation of the concrete mixture for the usage of the sample and sample incorporated with bamboo fiber with percentage of 1% and 3%. The results shows indicated a variety of bamboo fiber can be used, but with modest quantities and very minimal concrete tests performed. The concrete samples not incorporated with of bamboo fiber possessed the highest strength for both compression and flexural. The lowest strength which comprises compression and flexural goes to the concrete samples incorporated with 3% of bamboo fiber compared to the other two type of samples.

ABSTRAK

Konkrit hari ini menggabungkan banyak bahan-bahan tambahan untuk meningkatkan kualiti konkrit. Kajian ini memberi tumpuan kepada penggunaan bahan tambah semulajadi untuk dimasukkan ke dalam campuran konkrit khusus buluh serat. Buluh mempunyai ciri semula jadi yang boleh berkembang pesat, menjadikannya mudah menambah sumber dapat. Buluh adalah tumbuhan semula jadi dan biasanya ditanam di negara-negara tropika. Serat ini diperbuat daripada selulosa dan sedang dihasilkan dengan kaedah pemprosesan seperti mengukus dan merebus, dan banyak lagi. Dengan mencampurkan konkrit yang menggunakan bahan ini, ia akan memberi beberapa kelebihan yang mana lebih menjimatkan dan boleh dipercayai dari segi kualiti dan juga menyokong beban. Kajian ini dijalankan untuk menentukan sama ada atau tidak serat buluh boleh digunakan sebagai salah satu bahan untuk meningkatkan ketahanan konkrit (kekuatan mampatan) kualiti dan kekuatan lenturan daripada spesimen dan pesongan campuran konkrit dengan serat buluh. Gred konkrit 20 akan digunakan semasa penyediaan campuran konkrit untuk kegunaan sampel dan sampel digabungkan dengan serat buluh dengan peratusan sebanyak 1% dan 3%. Keputusan menunjukkan menunjukkan pelbagai serat buluh boleh digunakan, tetapi dengan kuantiti yang sederhana dan ujian konkrit sangat minimum dilaksanakan. Sampel konkrit yang tidak dicampur dengan serat buluh memiliki kekuatan tertinggi bagi kedua-dua ujian mampatan dan lenturan. Kekuatan paling rendah daripada ujian mampatan dan lenturan yang dilakukan ke atas sampel konkrit yang dicampur dengan 3% serat buluh berbanding dengan dua jenis sampel lagi.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Concrete work is the most important work in building for more than 80% in the structure is composed of concrete constructions. Concrete is a composite material made out of coarse granular material (the aggregates or fiber) combine in a hard lattice of material (the cement or binder) that fills the space around the total particles and pastes them together. The quality and quantity of materials to make concrete in certain grades obtained and controlled during the concrete mix done.

In addition, the new concrete development suggesting the implementation of newly engineered concrete as the solution in conserving the natural earth resources with additional factor on environmental friendly resources. There are many new engineered concrete was suggested in the previous decade. Either using artificial or natural fiber to be the replacement in the new invented concrete. One of the materials that had been used is wood fiber.

They are many incorporated concrete with addition, materials to improve the concrete is a material that literally forms the basis of our modern in society. Scarcely any aspect of our daily the lives does not depend directly or indirectly on the concrete.

We may your live, work life, student study, or play in the concrete to which extend we drive may be over concrete roads without knowing it. Concrete is the mostly used materials in the world. In principle, the manufacture of Portland cement is very simple and relies on the use of abundant raw materials. An intimate mixture, usually of limestone and clay, is heated in kiln to 1400 to 1600°C (2550 to 2900°F), which is the temperature range in which the two materials interact chemically to form the calcium silicates. In practice, because of the large amounts of materials being processed and the high temperature required, considerable attention must be paid to the various stages of processing if adequate control is to be maintained.

Though out this chapter, all information about problem statement, objective of the studies, and scope of work in the entire research process and the significant of the research will be clarified to give the basic overview for this entire research.

1.2 BACKGROUND OF STUDY

Concrete is the mostly used materials in the world. According to the Portland cement the Association, it is estimated that the annual production of cement is expected to access 5 billion cu yd.

Concrete is chosen as a construction materials because of it advantages. One of the advantages of concrete is it processes a high compressive strength. Concrete when properly prepared its strength is equal to that of a hard stone. This characteristic has made concrete popular materials in construction industry. There are many experimental and researched has been done by researcher in upgrading the quality of the concrete that already exist nowadays.

Aggregate normally occupy 70 to 80% of the quantity of concrete and can therefore be estimated to have an imperative influence on its properties. They are coarse material, derived for the most part form natural rock (crushed on stone, or natural and gravels) and sands, although the synthetic materials such as slags and expanded clay or shale are used to some extent, mostly in lightweight concretes. Having addition materials in concrete is part of the technology invention made by researcher to improve quality properties required in concrete itself. Example of common admixtures used in mixing concrete are divided into two which is chemical admixtures and mineral of admixtures. Usually these mineral admixtures are function to accelerate setting and hardening and thus to produced high early strength of the concrete, to reduced evolution of heart, and others function that is required and necessary for the concreting work.

Now they are many incorporated concrete with addition materials to improve the quality of the concrete. This study focuses on usage of the natural admixtures to be incorporated in the concrete mixtures specifically bamboo fiber. Bamboo is a group of woody perennial evergreen plants in the true grass family bamboo Poaceae, subfamily the Bambusoideae, tribe the Bambuseae. Some of it's the members are the giants, forming by the far of largest members of the grass of family bamboo. The new shoots of some of the larger species can grow over 1 m/day. They are of economic and the high cultural significance in East Asia and South East Asia where they are used for the extensively in gardens, as a building material as well as a food source.

Bamboo have naturally characteristic which can grow fast, making it an easily replenish able resource. Its fiber is made of cellulose and is being produced by processing methods such as steaming and boiling, and many more. Natural bamboo fiber textile is extracted directly from the bamboo culms, and completely different from the bamboo viscose, which is produced by product chemical processing.

1.3 PROBLEM STATEMENT

Nowadays, usage of chemical substance in construction is increase. Besides that, by creating a concrete using this material will give an advantages where more economic and reliable in term of quality and also supporting load. This chemical sometimes will give an effect to our environment.

Based on problem statement, the research will be conducted to determine whether or not the bamboo fiber can be used as one of many materials to increase concrete durability (compression strength) quality. Bamboo is natural vegetation and normally grown in tropical country.

Hopefully the result will provide more data to decide this material can be applied on construction or not. This study is about using a natural resource material which is a bamboo fiber one of the components in the concrete mixtures generally in Malaysian concrete. The research is conducted to determine whether or not the bamboo fiber can be used.

1.4 OBJECTIVE

- To investigation the effort of using bamboo fiber to concrete properties of compressive.

- To study the flexural strength of the concrete specimens and deflection of concrete mixed with bamboo fiber.

1.5 SCOPE OF STUDY

In order to achieved the objective of this study, a compression and deflection test was implemented which was accordance to the ASTM C-39 and ASTM C-78 respectively. The concrete grade of 30 was during the preparation of the concrete mixture for the usage of normal concrete as the control sample and sample incorporated with bamboo fiber with percentage of 1% and 3%. In this study a general type of bamboo was used as raw materials extracting the fiber. Size of bamboo fiber which is used in later experiments is between 10-50mm in order to facilitate the concrete mix. The fiber extracted from the bamboo tree was used in incorporated with the normal concrete that contain normal composition and preparation of concrete materials which are cement, aggregate and water. For the sizes of test samples are 100mm x 100mm x 100mm cube for compressive strength test, 1500mm x 200mm x 150mm plain concrete beam for flexural strength test and cylinder test sample with 100mm diameter and 200mm height for tensile strength test and modulus of elasticity test in the research.

1.6 SIGNIFICATION OF STUDY

His study hopes to achieve what has been outlined in the objectives and decided to find out the bamboo structure in concrete workability. There by achieving the standards set in concrete. This study was also based on several studies that have been made in Malaysia and abroad to know what conclusions they can do. As we know the nature of bamboo that can be fundamental in the construction of a wooden house. This is the first step in the study of fiber to move forward in particular to substitute bamboo reinforcement in the concrete industry. Bamboo is a natural plant that has the nature and durability of bamboo supply of oxygen is very high compared to other plants. In China there is a mess of construction has started using bamboo fiber in order to achieve the Green the campaign and residential buildings.

1.7 CONCLUSION

In conclusion, all the basic information to the study discussed in this chapter the whole, it has been noted that this study will include the determination of the workability and strength of concrete due to the implementation of fiber bamboo fiber reinforcement due to the number of tests on the parameters that will be explained in the next chapter. In the next chapter, some information about the case study that has been done will be stated in relationship study.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

In chapter 2, the literature review will include the presentation of past case studies really have reliable information that can be used in a way to complete this study, starting with basic information about setting concrete standards, composition, concrete engineering have been proposed, and also the information material to be used in this study as a major focus will be tested throughout this study later.

From the last chapter of chapter 1, we can take all of the main purposes of research with important information that can support the reliability of the causes and scope of work to be carried out for this study. Towards the large scope of the chapter, all information wants to be explained in this chapter will be presented either to improvement points or guidelines for conducting research in a standard and proper standards.

2.2 PROPERTIES OF CONCRETE

Fresh concrete is defined as concrete at the state when its components are fully mixed but its strength has not yet developed. This period corresponds to the cement hydration of stages start 1, 2, and 3. The properties of the fresh concrete directly influence the handling, placing and consolidation, as well as the properties of hardened concrete.

Beneficial Effects of Admixtures on Concrete Properties

Concrete Property	*Admixture Type*	*Category of Admixture*
Workability	Water reducers	Chemical
	Air-entraining agents	Air entraining
	Inert mineral powder	Mineral
	Pozzolans	Mineral
	Polymer latexes	Miscellaneous
Set control	Set accelerators	Chemical
	Set retarders	Chemical
Strength	Water reducers	Chemical
	Pozzolans	Mineral
	Polymer latexes	Miscellaneous
	Set retarders	Chemical
Durability	Air-entraining agents	Air entraining
	Pozzolans	Mineral
	Water reducers	Chemical
	Corrosion inhibitors	Miscellaneous
	Water-repellant admixtures	Miscellaneous
Special concretes	Polymer latexes	Miscellaneous
	Slags	Mineral
	Expansive admixtures	Miscellaneous
	Color pigments	Miscellaneous
	Gas-forming admixtures	Miscellaneous

Figure 2.1: Properties of Concrete

2.2.1 Concrete Strength

The concrete strength of a type is defined as the capability to refuse to accept stress without failure. Failure is sometimes recognized with the emergence of cracks. In concrete, then strength is related to the stress necessary to cause failure and it is defined as the utmost stress the concrete sample can withstand. In compression the test piece is considered to have unsuccessful even when no cipher of external fracture are noticeable however, the interior cracking has reached such an higher state the specimen is not

capable to take a higher load. In the practice most concrete is subjected simultaneously to a combination of compressive test are the easiest to perform in laboratory, and the 28day compressive strength of concrete strong-minded by a normal uniaxial compression test is accepted universally as general index of the concrete strength (Mehta, P.K., 1976).

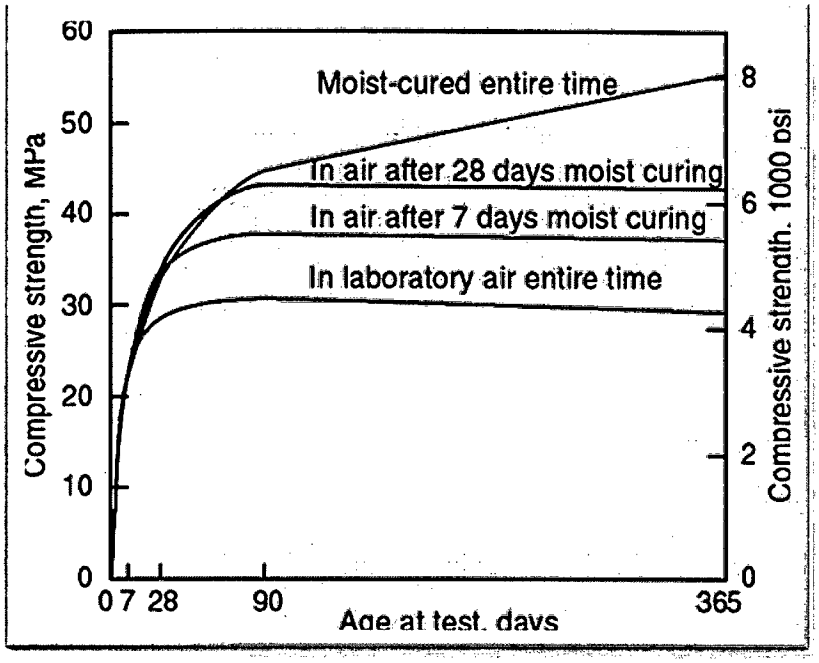

Figure 2.2: Concrete Strength

The elastic modulus of concrete is typically determined from test data up to concerning 40% of the ultimate high strength (i.e., within or slightly further than the linear range). Ever since concrete is a composite material creation up of the hardened stick (with pores) and the aggregates, its modulus can be predict from composite models. The modulus of the paste increases with decreasing porosity so paste with lower w/c ratio is stiffer.

Empirically, the paste modulus is found to vary with (1-p)3, where p is the porosity. To get hold of the concrete modulus Ec from the stick modulus Expand aggregate modulus Ea, three models have been proposed (Monterio, P.J.M., 2006).

(i) Parallel model (aggregate and paste under the same strain)

$$Ec = VaEa + VpEp$$

Va: volume fraction of aggregate

Vp= 1 – Va= volume fraction of paste

(ii) Series model (aggregate and paste under the same stress)

$$Ec = [(Va/Ea) + (Vp/)] ^-1$$

(iii) Square in square model

Aggregates are assumed to be completed surrounded by cement, and the composite is simplified into a system of square in the square. To find the concrete modulus, of the system is assumed to be one made of two layers of pure paste in series with a layer consisting of paste and aggregate in parallel.

2.2.2 Durability of Concrete

A long check life is considered identical with durability. As durability under one set of situation does not of necessity mean durability under, it is expected to include a general position to the environment when important for the durability. According in the direction of the source ACI Committee 201, durability of the Portland cement concrete is a defined as its ability to resist for weathering on action, the chemical attack, and abrasion, or any other process of deterioration. In other words, a durable concrete will retain its original form concrete, the quality and for serviceability when exposed to its intended service of environment in the world.

No material is inherently durable. The material is assumed to reach the end for service life when its properties, for the under given conditions of use, have the deteriorated to an extent that its continued use is ruled either unsafe or uneconomical.

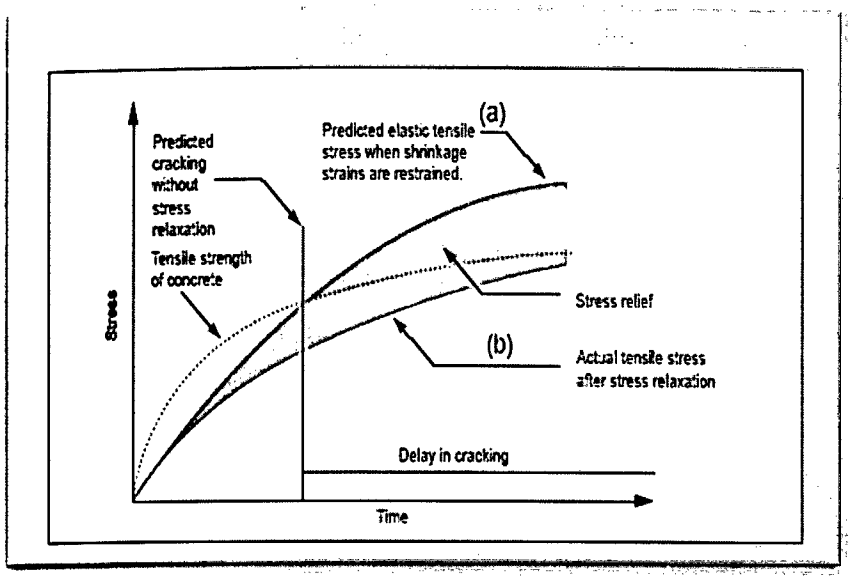

Figure 2.3: Durability of Concrete

2.2.3 Workability of Concrete

Workability of concrete is distinct in ASTM C-125 as the possessions determining the attempt required to manipulate a newly mixed quantity of concrete with minimum defeat of the homogeneity. The term manipulation includes the early-age for operations of placing, the compacting, and for finishing. There for effort required to place a concrete mixture is determined largely by the overall work needed to initiate and maintain for flow, which depends for the rheological possessions of the lubricant (the cement paste) and the interior friction between the aggregate particle on the hand over, and the exterior of the formwork on the other.

Consistency, measured by the slump-cone test or Vebe apparatus, is used as a simple index for mobility or flow ability of fresh concrete. The attempt required to dense concrete is governed by the flow characteristics and the effortlessness with which void reduction can be achieved with no destroying the stability under pressure.

Stability is an index for both the water-holding capacity (the opposite of bleeding) and the coarse-aggregate-holding capacity. A qualitative measure of these two characteristics is generally covered by the term cohesiveness. It should be apparent by now that workability is a composite the property, with at least two the main components:

- For the consistency-describes the ease of flow
- For the cohesiveness-describes the stability or lack of bleeding and segregation characteristics.

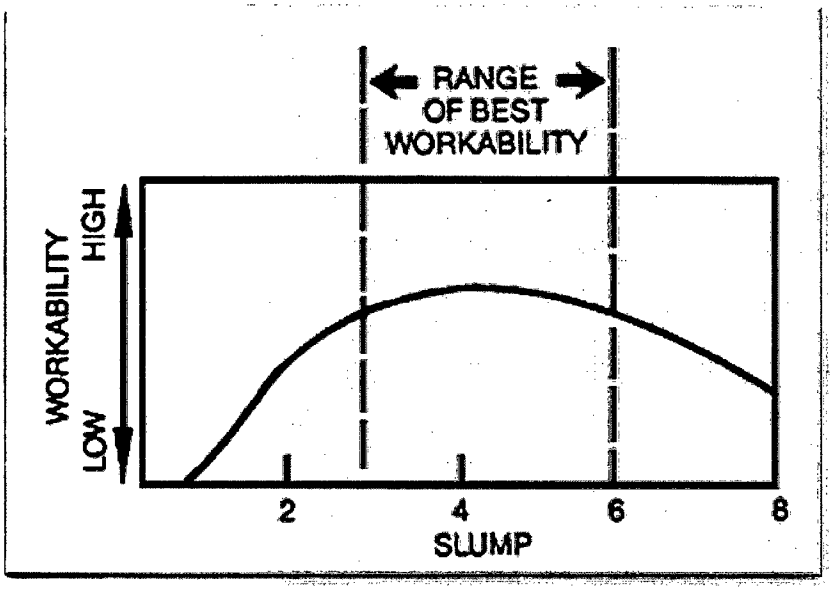

Figure 2.4: Workability of Concrete

2.3 CURING

According to ACI clause 5.11, the curing of concrete be supposed to maintained above 50°F and in a the majority condition for at smallest amount the first 7days after position, high early strength concrete ought to be maintained above 50°F and in a clammy condition for at least the first 3 days. Curing has a physically powerful influence on the properties of the hardened of concrete, proper of curing will increase

the durability, strength, and resistance to freezing and thawing and deicers. (Woodson, R. D, 1995)

Once the Portland cement is mixed with the water, a chemical for response called hydration takes the place. There is extent to which the reaction is the completed influences the strength and durability of concrete. Fresh concrete mixed usually contains more water than is necessary for hydration of the cement however; the excessive loss of water by the evaporation can delay or prevent adequate hydration. The outside is particularly predisposed to insufficient hydration because it dry first. If for temperatures are favorable, hydration is relatively it is important for water to be retained in the concrete mix during this period that is, for evaporation to be the prevented or substantially abridged.

By means of proper curing, concrete becomes the stronger, more for impermeable, and more the resistant to the stress, for abrasion, freezing and thawing. The development is rapid at early ages but continues additional slowly thereafter for an indefinite period. Figure 2.5 shows the strength increase of concrete with age for dissimilar moist curing periods and demonstrate relative strength achieve of concrete cured at different temperature. (Mehta, P.K., 2006).

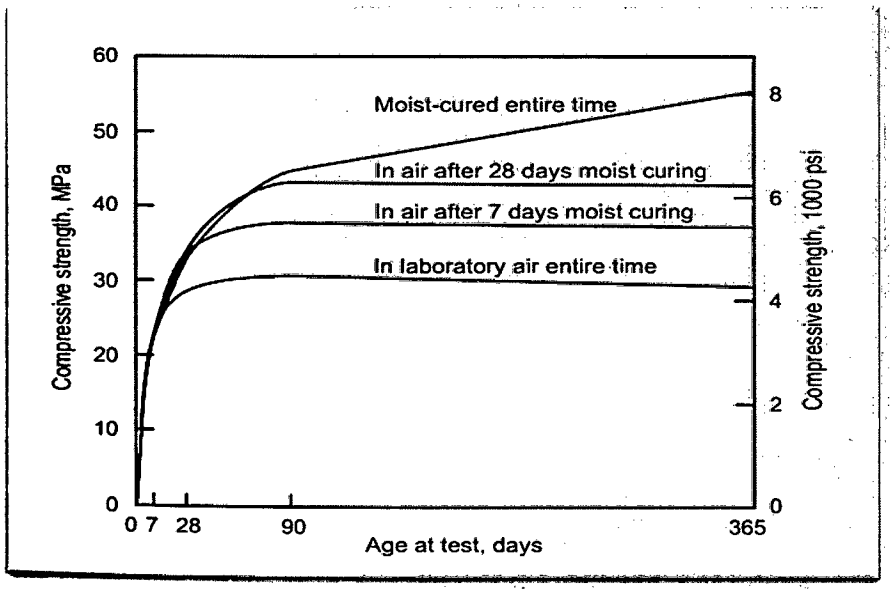

Figure 2.5: Compressive Strength of Curing

The most effective method for curing concrete depends on the materials used in concrete, method of the construction, and the intend use of the hardened concrete. For most jobs, curing generally involves applying curing the compounds, or covering the fresh placed and finished the concrete mix by resistant sheets or wet burlap concrete. In another various cases, such as in hot and the cold weather, special care by means of other precautions is desirable.

2.4 BAMBOO

Bamboos are huge, woody grasses rising in tropical and subtropical (cosmopolitan) climate, with distribution ranges covering wide areas of Asia, Africa, and the Caribbean and Latin America (Lu et al, 2005). It can grow to over 100 feet which is the growing plant on this planet. It grows in many different climates, from jungles to high on mountainsides. It is believed that it grows one third faster than the fastest growing tree.

According to Rao (2005), bamboo is a characteristic natural multiple material and the fibers are discrete densely in the outer outside region and thinly in the inner surface region. It is obvious that the crack toughness of the bamboo depends on the volume small part of fibers. The bamboo have multi-nodes and functionally incline structure, macroscopically as healthy as microscopically. The produce of the absorption of water on mechanical property of bamboo has also been deliberate.

Janssen (1990) mentioned that the bamboo is in the size, lightness and strength an extreme product of the nature. It is stable because of it's the cavities an extreme light and the stretch building material. The reinforcement by diagrams and its substantial conditions cause its massive superiority compared to other by resources.

It is one of the strongest buildings of materials, with the tensile strength that rivals steel and weight-to-strength ratio surpassing that of graphics. It withstands awake to the 52,000 pounds of unit pressure psi. Through a 10-30% annual add to in biomass versus 2-5% for trees, bamboo creates better yields of raw material for use. One bamboo cluster can produce 200 poles inside the five years it takes one tree to arrive at maturity.

According to Francis and Paul (1996), the make use of of bamboo as reinforcement in Portland cement concrete have been studied extensively by Clemson Agricultural College. Bamboo have been second-hand as a construction material within certain areas for industries, other than its application as reinforcement in concrete have received little attention motionless the Clemson study.

2.5 BAMBOO IN CONSTRUCTION

Bamboo has a long tradition and the nature of sound as a building material throughout the tropical and sub -tropical regions of the world. Bamboo is also a renewable and versatile, features raced there in the bamboo is of high strength and low weight, and easy to work using simple tools. Therefore, the construction of bamboo is in a category that is easy to build, resilient to wind and also the nature of natural disasters such as earthquakes and ready to be repaired in the event of damage. Products related to this bamboo (bamboo -based panels and bamboo reinforced concrete, for example) also find application in the construction process. (Xiao et al.eds 2008).

However there are some considerations that need to be taken care and attention that is important to limit the use of bamboo as a building material universally applicable:

• Durability: Bamboo is subject to attack by fungi and insects. For this reason, the structure is seen as a temporary bamboo treated with useful life of more than five years.
• Connectivity: although many of the traditional co- exist, their structural efficiency is low (Herbert et al 1979.).
• Flammability: bamboo structure does not behave well in fires, and the cost of treatment, if any, is quite high.

The majority of bamboo construction related to the needs of rural communities in developing countries such as China, Japan and Brazil. Thus, the domestic housing dominates and, in accordance with their origins in rural areas, building simple scale for the design and construction also depends on traditional skills and methods of living.